Status Report - July 1, 1964

National Aeronautics and Space Administration Research Grant NsG-355 (July 1, 1963 - July 1, 1964) to Northeastern University, Boston, Massachusetts

"Certain Theoretical Antenna Problems for Radio Astronomy"

by

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The research program during this period was concerned with (1) obtaining theoretical parameters to aid in the actual antenna design (2) correlating theory and experiment and (3) gaining an understanding of the operation of a long antenna in a plasma environment. Parts (1) and (2) above are covered in detail in a forthcoming scientific report. Part (3) above was covered in a report by M. A. Islam dated May 1, 1964 (M. A. Islam, "Theory of Dielectric Coated Linear Antennas," Scientific Report No. 1, Grant No. NsG-355, Northeastern University, May 1, 1964). A brief summary of the status of the research program is given below.

(1) The effective area of a satellite borne antenna is a function of the radiation pattern and the driving point impedance of the antenna. The driving point impedance and current of the traveling wave V-antenna is obtained as a superposition of

resonant length antennas. The correct current and impedance of resonant length antennas has been given by a new theory. This theory has been checked with dependable theoretical values for the driving point impedance of long cylindrical antennas. This is the first theory to give accurate simple trigonometric representations for the current. At present this theory is being programmed to give the driving point impedance and current of the travelling wave V-antenna. This impedance is calculated from the self and mutual impedances. The theory will also predict the optimum value of load resistance for the antenna.

The complete far field pattern for the V-antenna has been programmed and results have been available for comparison with experimental results obtained by Izuka at Harvard University (Division of Engineering and Applied Physics.) The directive gain and the ratio of power within a given cone angle to the total power are also being computed. A simple trial current was used for the radiation pattern computations.

(2) The correlation is very good between the theoretical field patterns and the experimental results of Izuka. A small difference in side lobe level and beamwidth is present but it is hoped that a better agreement will be given by an improved current. This improved current is not yet computed. No theoretical results are available from the machine for the driving point impedance. Experimental driving point impedances were measured by B. Duff at Harvard and are available for comparison.